

**REMARKS**

Claims 1-3, 5-7, 11-15 and 17-26 are pending in the above-identified application. Claim 1 is amended to incorporate claim 9.

**Issues under 35 USC 103(a)**

Claims 1-2, 9, 11-15 and 19-26 have been rejected under 35 USC 103(a) as being unpatentable over Tsukamoto '985 (JP 2000-143985) in view of Nakamura '862 (US 6,582,862).

Claim 3 has been rejected under 35 USC 103(a) as being unpatentable over Tsukamoto '985, Nakamura '862 and Tanaka '006 (US 2004/0236006).

Claims 5-7 and 17-18 have been rejected under 35 USC 103(a) as being unpatentable over Tsukamoto '985, Nakamura '862 and Hedaya '492 (US 4,208,492).

These rejections are traversed based on the reasons below.

**Present Invention and Its Advantages**

The present invention is directed to a black composition which includes a titanium nitride oxide component and carbon black, together with an acrylic resin in a recited ratio range, wherein the titanium nitride oxide component is photo-curable, and which satisfies Equations (1)-(4), as recited in amended claim 1, for example. By employing carbon black together with titanium nitride oxide, a black matrix having a neutral black can be attained and the development margin advantageously increased. This is described on page 18, line 2 from the bottom to page 19, line 4 of the specification. These advantageous effects are clearly evident if one compares Example 8 and Example 9. More particularly, the composition of Example 8 contains titanium nitride oxide alone while the composition of Example 9 contains titanium nitride oxide and carbon black at a ratio of 50/50 by weight. In Example 9, a black composition having a black color without coloration was obtained, and the resolution was advantageously higher and the development margin was wider than those attained by using the composition of Example 8.

Also, as noted previously, the black composition of the present invention in the form of a film specifically transmits i-ray ultraviolet light. By virtue of this property, a low exposure energy of not more than  $60 \text{ mJ/cm}^2$  can be used for the black composition of the present invention. Typically, if a black light shading agent is added to a composition similar to that of the present invention, the transmittance of i-ray ultraviolet light decreases for the same exposure

energy level. As a result, attempts at patterning the film using light become difficult, which is a problem in this technical field. However, unexpectedly and unpredictably, employment of titanium nitride oxide, as in the present invention, results in advantageously improved i-ray transmittance, while maintaining desired light shading properties of the film. As a result, in addition to the high OD value and good adhesion, a resin black matrix having vertical edge portions may be obtained in accordance with the present invention (see also page 9, lines 9-10 of Applicants' specification).

Regarding Equation (3)  $0.70 < R_1 \leq 0.82$  and Equation (4)  $0.85 < R_2 < 1.80$ , it is noted as described at page 8, line 25 to page 9, line 19 that if both Equations (3) and (4) are satisfied, the result is a black composition which exhibits advantageously high optical density (OD) and high adhesion properties. Note further that this is evident from a review of the comparative test evidence, including the descriptions of Examples 1-3 at pages 24-27 of the specification, as well as the description of Comparative Examples 1 and 2 at pages 28-29 of the specification. In this regard, it is submitted that Examples 1-3 (present invention) exhibit advantageously improved properties with respect to high OD and high adhesiveness when compared to Comparative Examples 1 and 2 wherein Equations (3) and (4) fail to be satisfied. It is additionally noted that the  $R_1$  value employed in Comparative Examples 1 and 2 appears to satisfy the equation mentioned in Tsukamoto '985 discussed in more detail below.

#### Previous Submission of Nagase Declaration

Applicant submitted with the Amendment filed July 29, 2009 a Declaration under 37 CFR 1.132 (hereinafter the "Nagase Declaration"). The Nagase Declaration describes an analysis of the composition of Example 1 of Tsukamoto '985 which indicates that this composition: [1] fails to exhibit the optical density (OD value) of not less than 4.4 per 1  $\mu\text{m}$  of thickness; and [2] fails to be photo-curable such that this composition cannot exhibit any photo-curing properties, let alone a minimum exposure energy for photo-curing of not more than 60  $\text{mJ}/\text{cm}^2$  as required by the present invention. Regarding item [2], it is further noted that in order for a composition to be photo-curable, it must contain a photopolymerization monomer and a photoinitiator. Neither of these components are present in the compositions of Tsukamoto '985.

Concerning the presently claimed invention, it is noted that the presence of titanium nitride oxide (or "titanium black") as a light shading agent is somewhat surprising, since one

could predict that the presence of a light shading agent in such a composition would prevent it from photo-curing properly due to the failure of the photo-curing light to sufficiently penetrate the composition for the photo-curing reaction to properly proceed. However, as explained at page 19 of the present specification, the type of titanium used in the composition of the present invention apparently transmits ultraviolet light at a higher level than other shading agents, and traps radicals generated by irradiation with light at a much lower level than other shading agents such that a larger amount of radicals is available to continue the photo-curing reaction.

Tsukamoto '985 neither discloses nor suggests to one skilled in the art how to obtain these advantages.

#### Distinctions over Cited References

Tsukamoto '985 discloses a black coating composition which includes a titanium nitride oxide component and wherein the intensity ratio  $R$  satisfies the equation  $R = I_3 / \{I_3 + 1.8(I_1 + 1.8I_2)\}$  of  $> 0.24$ . Tsukamoto '985 also includes Figure 1 which shows  $I_1$  and  $I_2$  values for an example of the black composition therein. It appears from a review of Figure 1 that the value of  $I_2/I_1$  is about 0.6 for Tsukamoto '985.

Tsukamoto '985 fails to disclose or suggest a composition that contains the combination of titanium nitride oxide and carbon black, as in the present invention. Tsukamoto '985 also fails to disclose or suggest a composition which is photo-curable as in the present invention. As evidenced by the results of the Nagase Declaration discussed above, the compositions of Tsukamoto '985 cannot be photo-cured due to the absence of any photopolymerizable monomer or photoinitiator. Also, the Nagase Declaration establishes that the compositions of Tsukamoto '985 fail to exhibit the advantageous optical density (OD) properties of the present invention.

Tsukamoto '985 also fails to disclose selecting an appropriate titanium nitride oxide component in order to satisfy Equations (3) and (4) for the black composition recited in the present claims such as in claim 1. Note that the  $R_2$  value of 0.6 for Tsukamoto '985 clearly falls outside the range of Equation (4) in claim 1 which requires a minimum of 0.85. Tsukamoto '985 fails to disclose a basis for one skilled in the art to select appropriate components in order to satisfy Equations (3) and (4) so as to obtain the black composition of the present invention. Tsukamoto '985 further fails to recognize the advantageously improved high OD and high adhesion properties achieved by the black composition of the present invention as evidenced by

the comparative test results discussed above in connection with Examples 1-3 (present invention) and Comparative Examples 1 and 2 as described in the present specification. Therefore, significant patentable distinctions exist between the present invention and Tsukamoto '985, such that this basis for the above-noted rejections fails. Even if Tsukamoto '985 is properly cited as a basis for asserting prima facie obviousness, such obviousness has been rebutted by the evidence of unexpected advantageous properties described in the present specification. Therefore, it is requested that the above-noted rejections be withdrawn.

Nakamura '862 and Tanaka '006 both fail to make up for the above deficiencies of Tsukamoto '985. Nakamura '862 describes a photo curable resin, while Tanaka '006 describes compositions used to make color filters. Both Nakamura '862 and Tanaka '006 fail to disclose or suggest the combination of titanium nitride oxide and carbon black, as in the present invention. Thus, the above rejections based on Tsukamoto '985 and Nakamura '862 and/or Tanaka '006 must be withdrawn.

Hedaya '492 also fails to disclose or suggest a composition that contains the combination of titanium nitride oxide and carbon black, as in the present invention. Hedaya '492 further fails to disclose or suggest the required properties based on Equations (1)-(4) as recited in the present claims. Hedaya '492 also fails to make up for the deficiencies of Tsukamoto '985 as discussed above. Hedaya '492 further fails to recognize the unexpected advantageous properties achieved by the present invention as evidenced by the comparative test results discussed above. Consequently, significant patentable distinctions exist between the present claims and Hedaya '492, even if this reference is hypothetically combined with Tsukamoto '985.

It is submitted for the reasons above that the present claims define patentable subject matter such that this application should now be placed in condition for allowance.

If any questions arise in the above matters, please contact Applicant's representative, Andrew D. Meikle (Reg. No. 32,868), in the Washington Metropolitan Area at the phone number listed below.

If necessary, the Director is hereby authorized in this, concurrent, and future replies to charge any fees required during the pendency of the above-identified application or credit any overpayment to Deposit Account No. 02-2448.

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Respectfully submitted,

By 

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